Revised Estimates of Premature Death Associated with PM2.5 Exposures in California

Public Workshop

June 25, 2008
California Air Resources Board
Sierra Hearing Room

Air Resources Board

California Environmental Protection Agency

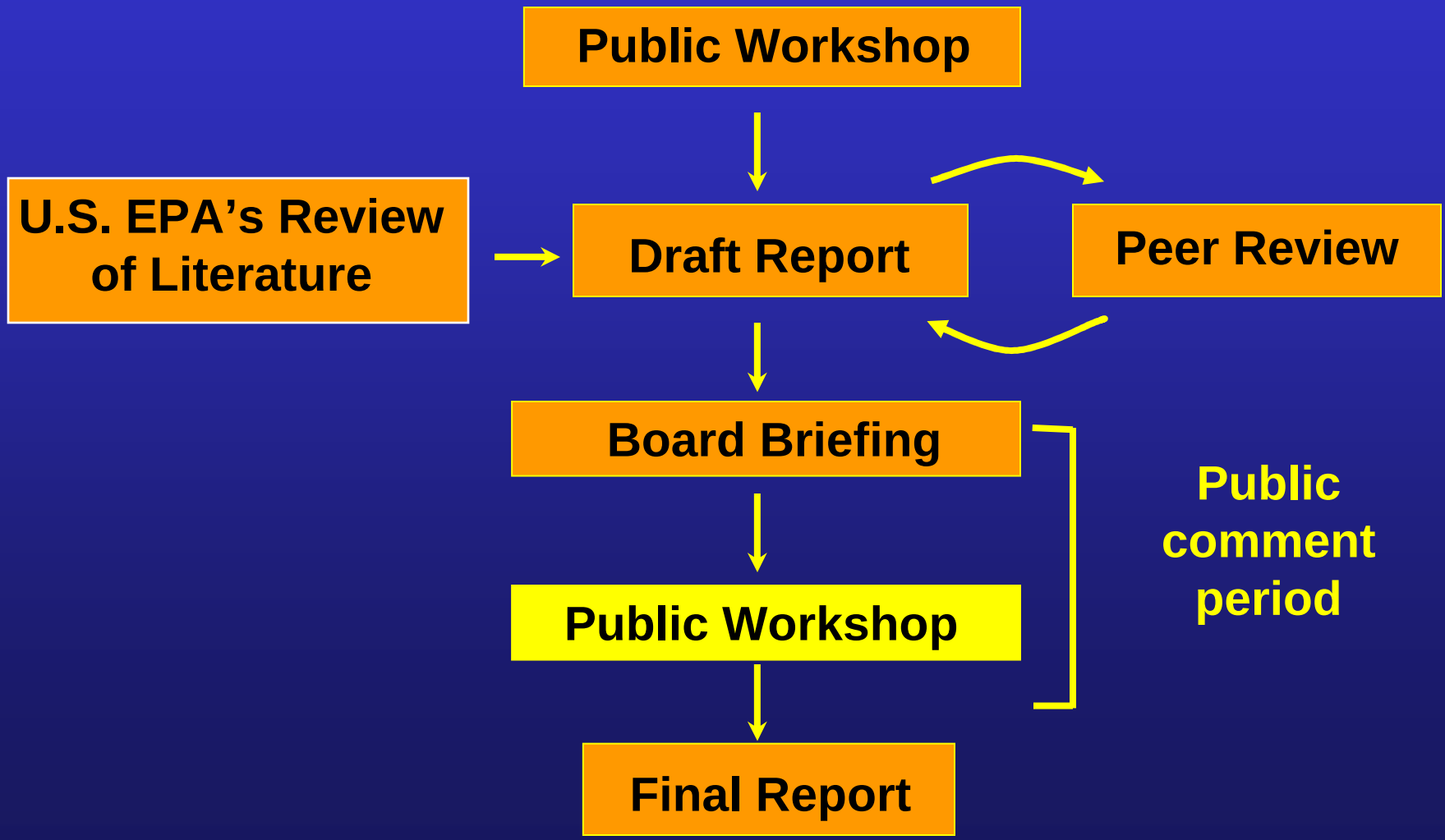
Overview

- Background on ARB's health impacts analysis
- Updated methodology
- New estimates of premature deaths

ARB's Health Impacts Analysis

- Estimate health impacts associated with public exposures to ambient levels of ozone and PM
- Estimate benefits associated with proposed diesel PM regulations to reduce emissions
- Board requested update in light of new studies

Key Steps in ARB's Update of Estimates



Scientific Review

Peer Reviewers

- Dr. Jeffrey R. Brook, Environment Canada
- Dr. Mark D. Eisner, UC San Francisco
- Dr. Richard C. Flagan, CA Inst. of Technology
- Dr. Alan E. Hubbard, UC Berkeley
- Dr. Joel D. Kaufman, U. of Washington
- Dr. Joel D. Schwartz, Harvard University

Advisors

- Dr. Jonathan Levy, Harvard University
- Dr. Bart Ostro, Office of Environmental Health Hazard Assessment
- Dr. Arden Pope, Brigham Young University

Overview of Revisions to Methodology

- Impacts associated with ambient PM exposure
- Benefits of attaining standards
- Impacts associated with diesel PM exposure

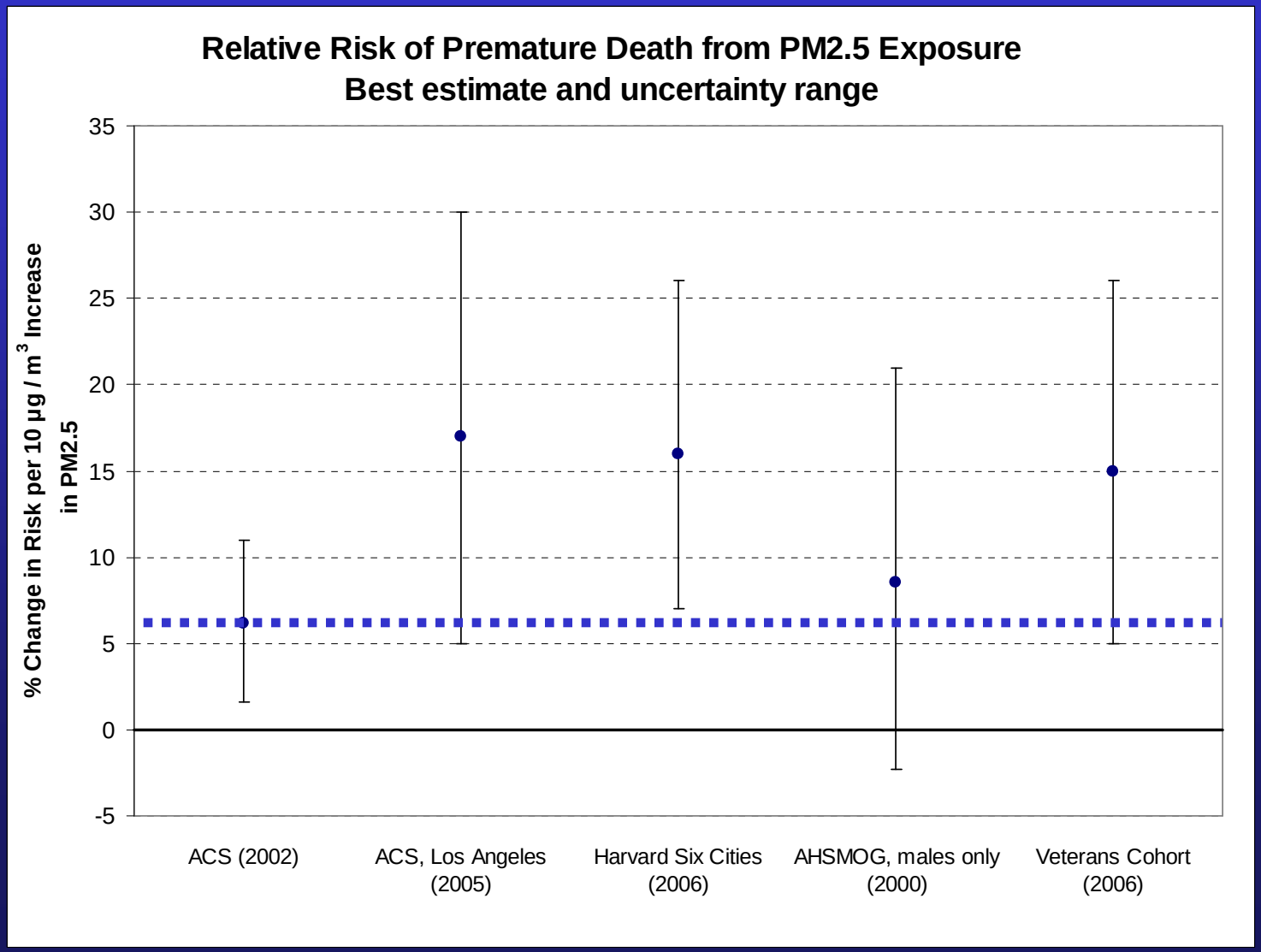
Estimating Impacts Associated with Ambient PM Exposure

- New estimate of PM2.5-premature death relative risk
- Health impacts associated with exposures below the annual standard of 12 $\mu g/m^3$
- 2004 to 2006 ambient data

Criteria for Evaluating Studies

- Mortality due to long-term exposure
- Location of study
- Controlling for co-pollutants and other confounding factors

Summary of Results from Key Studies



Revised Concentration-Response Relationship

- 10% increased risk of premature death per 10 μg/m^3 increase in long-term PM2.5 exposures
  - ➢Median of U.S. EPA expert elicitation*
  - ➢Current estimate is 6%
- Uncertainty interval: 3% to 20%

*** Roman et al., Environ. Sci. Technol. 2008, 42, 2268–2274**

Other Analyses Consistent with Our Estimate of Increased Risk

- Results from U.S. EPA's reviews of literature statistically treated various ways
  - Pooling: Equal weight, inverse variance, random effects
- Results from major cohort studies
- European experts convened to survey interpretations of the literature*

*Cooke et al., Environ. Sci. Technol. 2007, 41, 6598-6605

Threshold for Premature Death

- Literature suggests increased premature death occurs at levels well below 12 $\mu g/m^3$
- New approach uses a range of levels
  - 7 $\mu g/m^3$: lowest level measured in American Cancer Society studies
  - 2.5 $\mu g/m^3$: background level in California

Revised Estimated Premature Deaths Associated with Ambient PM2.5

- About 14,000 to 24,000* premature deaths annually estimated to be associated with long-term exposures to PM2.5
- A majority of the impacts occur in
  - South Coast
  - San Joaquin Valley
  - San Francisco Bay

*Uncertainty interval: 4,300 to 41,000 deaths.

Overview of Revisions to Methodology

- Impacts associated with ambient PM Exposure
- Benefits of attaining standards
- Impacts associated with diesel PM exposure

Estimating Benefits of Attaining Air Quality Standards

- Roll current PM into attainment scenario

$$\text{Rollback Factor} = \frac{\text{Standard} - \text{Background}}{\text{Basin Max} - \text{Background}}$$

- Rollback Factor: The percentage reduction needed to bring the basin high value towards attainment
- At all sites within the basin, PM above background are shrunk by the rollback factor

Estimated Benefits of Attaining Air Quality Standards

- Federal Standard: 15 µg/m^3
  - ➢5,500 premature deaths
- State Standard: 12 µg/m^3
  - ➢9,300 premature deaths

Overview of Revisions to Methodology

- Impacts associated with ambient PM Exposure
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Estimating Ambient Diesel PM Concentrations

- Updated the methodology for estimating ambient diesel PM concentrations
- Diesel PM concentration proportional to ambient NO_X concentration

  [Diesel PM] = alpha*[NO_X]
- Ambient NO_X measured at ARB monitoring stations

Proportionality Constant Between Diesel PM and NO_X

- Ambient* and emissions inventory approaches result in similar proportionality constant, alpha
- Greater variation in rural versus urban areas

*based on apportionment of ambient PM to sources

New Estimates of Premature Deaths Associated with Diesel PM

- Based on new relationship, about 3,900 premature deaths were associated with primary diesel PM emissions in 2000
  - Uncertainty interval: 1,200 to 7,100 deaths
  - Previous estimate was 2,200 deaths

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Summary of Proposed Revisions

	Current	*Proposed*
Increased Risk per 10 µg/m^3	6%	10%
Lowest level of effect	12 µg/m^3	Range of 7 to 2.5 µg/m^3
Air quality data	Year 1999/2000	Year 2004-2006
Annual premature deaths (ambient PM)	8,200	14,000 to 24,000
Benefit of attaining federal standard (15 µg/m^3)	---	5,500
Benefit of attaining State standard (12 µg/m^3)	---	9,300
Primary diesel PM premature deaths in 2000	2,200	3,900

Timeline for Completion of Staff Report

May 22, 2008	Draft report released at Board briefing
June 25, 2008	Public workshop
July 11, 2008	Public comment period ends
August 2008	Final staff report released

Additional Information

- Comments on report due July 11 to:
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- PM mortality methodology website:
  http://www.arb.ca.gov/research/health/pm-mort/pm-mort.htm